MESOZOIC INSECTS OF QUEENSLAND.

No. 8. Hemiptera Homoptera (Contd.). The Genus Mesogereon; with a Discussion of its Relationship with the Jurassic Palaeontinidae.

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(With Plates xvi.—xxi. and seven Text-figures).

The genus *Mesogereon* was first proposed by me (1916, p. 33), for the reception of a fragment of a very remarkable forewing from the Upper Trias of Ipswich, Queensland. The name was chosen because of a certain amount of resemblance between the fragment and the well known Permian fossil *Eugereon boeckingi* Dohrn (1867), which Handlirsch (1908, p. 389) has placed alone in a new Order Protohemiptera. The name which I gave to this Upper Triassic wing-fragment was *Mesogereon neuropunctatum*, the specific name being an allusion to the remarkable formation of cross-ridges running between the main veins, and interrupted midway by an unridged area carrying strongly marked tubercles or macrotrichial sockets. This formation was interpreted as being that of a series of original cross-veins, or *archedictyon*, in process of reduction. The condition of the fossil in this respect was held to indicate that it represented an intermediate stage between Handlirsch's Fossil Order Protohemiptera and his Palaeohemiptera, and a doubt was expressed as to whether two distinct Orders should be maintained. Later evidence obtained from a study of other fossil Hemiptera has already convinced me (1918) that Handlirsch's Palaeohemiptera should be considered as only a Sub-order of the Order Hemiptera, while the Protohemiptera, as represented by *Eugereon*, stand out so distinctly that they must certainly be maintained as a good Order. *Mesogereon* itself was placed by me in the Order Protohemiptera, since it appeared probable, from the venation preserved in the fragment, that the complete wing, when discovered, might have a venational scheme not unlike that of *Eugereon*.

In the two consignments of Ipswich fossils received by me from Mr. Dunstan since my first paper was written, there is a considerable amount of material belonging to the genus *Mesogereon*. This includes no less than three forewings,

one of them in a magnificent state of preservation, and two fragments of hindwings. The type of wing represented by this material turns out to be very different from what I had surmised on the basis of the original fragment. They are evidently the wings of true Homoptera, but so unlike any known forms that I was for a long time in doubt as to where to place them, and finally decided to allot a separate Part to them, so as to allow of a full discussion of their true affinities. In this study I have had the good fortune, during my recent voyage round the world, to see for myself, and to study carefully, the types of two of the Jurassic fossils of the family *Palaeontinidae*, viz. *Palaeontina oolitica* Butler and *Eocicada lameerei* Handl., together with a number of undescribed specimens of this family from Solenhofen, which are in the Collection of the Museum of Comparative Zoology at Cambridge, Mass., U.S.A. This family has been placed by Handlirsch in the Order Lepidoptera. As will be shown in this paper, they are, as a matter of fact, a family of extinct Homoptera related to the Cicadas, as Oppenheim and Haase originally considered some of them to be. The genus *Mesogereon* is closely related to these Jurassic insects, and through them to the existing Cicadas also.

A careful study of the four forewings of *Mesogereon* (inclusive of the original fragment) shows that there are so many important differences that no two of them can be considered as conspecific. The original type of the genus, *Mesogereon neuropunctatum* Till., bears the number 19*a* of the Collection of Ipswich Fossils in the Geological Survey at Brisbane. The next specimens to be received were Nos. 206*a* and 207*a*. Of these, the former is a fairly complete forewing, with some of the apical border missing, and many of the main veins badly buckled at about two-thirds their lengths. This wing will be described as *Mesogereon affine*, n.sp. in this paper. No. 207*a* appeared to be, at first sight, an entirely different and much smaller wing. It was found only a few inches away from No. 206*a*, in the same layer of shale. After making careful drawings of this wing, which is by no means complete, I was struck with the fact that it possesses several peculiarities closely comparable with those to be found in the forewings of *Mesogereon*, and quite unlike anything else known in the Ipswich fossils. I therefore concluded that this specimen was part of the hitherto unknown hindwing of this genus. As it was found so close to No. 206*a*, I have decided to consider it as the hindwing of *M. affine*, n.sp., though, of course, it is impossible to prove this strictly, as the two wings were not attached *in situ* to the body of one insect.

Just before I left Australia in April, 1920, Mr. Dunstan forwarded me the remainder of the material dealt with in this paper. This consisted of three specimens numbered 169, 144*a* and 97 respectively. No. 169 is a magnificent wing, complete except for a small piece missing from the costal margin and another small piece from the apex. Its state of preservation is so perfect that even the impressions of some of the hairs carried by the macrotrichial sockets on the wing-membrane are visible, and have been most beautifully photographed by Mr. W. C. Davies in Plate xvii., fig. 19. The ambient vein and coriaceous border (Plate xviii., fig. 20), typical of the Homoptera, are here, for the first time, shown in their perfection, leaving no doubt as to the correct placing of these insects in the Order Homoptera. This wing is here described under the name *M. superbum*, n.sp. No. 97 is a hindwing, more complete than No. 207*a*. It shows, for the first time, a small portion of the ambient vein and coriaceous border (Plate xxi., fig. 25) resembling those of the forewing, and thus definitely settling the question as to the genus to which these two wings belong.

This wing may possibly be the hindwing of *M. superbum;* but, in the absence of any direct evidence, I have considered it necessary to give it a separate name. It will therefore be here described as *M. shepherdi*, n.sp. after Mr. S. R. L. Shepherd, an energetic officer of the Queensland Geological Survey, who unearthed many of these fossil insects. No. 144*a* is a nearly complete forewing, not very well preserved, and with the main veins somewhat crushed and compressed together. It will be described as *M. compressum*, n.sp.

The original definition of the genus *Mesogereon* given by me on the characters shown in the type fragment now appears quite inadequate, and will be greatly added to in this paper.

The photographic enlargements shown in the Plates are all the work of Mr. W. C. Davies, Curator of the Cawthron Institute, to whom my best thanks are due for such remarkably fine illustrations of these interesting fossils.

Descriptions of the Fossils.

Order **HEMIPTERA**.

Sub-order **Homoptera**.

Family MESOGEREONIDAE, fam. nov.

Large, Cicada-like insects, without sound-producing apparatus. Forewings greatly elongated, little more than one-fourth as wide as long; clavus less than one-fourth the wing-length, very narrow; rest of wing with the main veins diverging gently from one another at regular intervals across the wing; a few cross-veins present in the basal third, but the rest of the wing entirely devoid of such; ambient vein and coriaceous border complete from above apex round to distal end of clavus. Hindwings short and broad, only half as long as forewing or less; main veins diverging regularly across the wing, with no cross-veins in the distal half; ambient vein and coriaceous border present as in forewing. In the forewing, Sc, R and Rs are all placed close together near the costal border; from Cu_1 a long anterior branch (*m-cu*) arises near the base and runs distad to meet M_4 a little beyond its point of origin. In the hindwing, Sc, R and Rs are more normally placed, and *m-cu* is not elongated. Except on the clavus, which is smooth, the forewing is remarkable for the regularly arranged cross-ridges between the main veins; each of these ridges is interrupted in the middle by an area carrying strongly tuberculate macrotrichial sockets, from which stiff hairs project distad (Plate xvii., fig. 19). These structures are absent from the hindwing, which is covered all over with much finer and more closely arranged pits, each of which probably carried a very fine hair.

Closely related to the Jurassic *Palaeontinidae*, from which they differ chiefly in the shape and sculpture of the wings. Also related more remotely to the existing *Cicadidae*, in many of which the remains of the regular cross-ridging of the forewing can still be seen, but in which the main veins in the distal part of the wing are always connected by strong cross-veins.

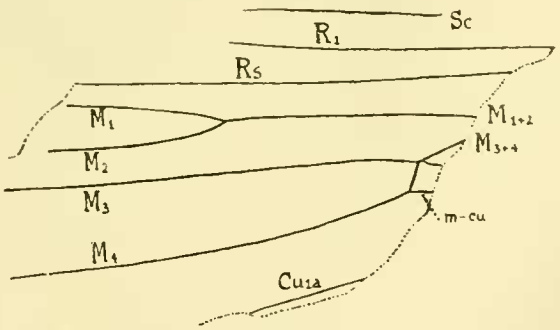
Genus Mesogereon Tillyard.

Tillyard, Mesozoic and Tertiary Insects of Queensland and New South Wales, Queensland Geol. Survey, Publ. No. 253, 1916, p. 33.

The definition of this genus can now be amended as follows:—To the characters given for the family add the following venational details:—*Forewing*: Rs arising close to base and dividing at less than one-fourth of the wing-length into

two closely parallel branches, which later on diverge somewhat towards the apex; both of these branches remain simple. M four-branched, its main stem weakly formed; M_4 arises obliquely downwards from M_{3-4} at a point nearer the base than is the forking of M_{1-2}, and shortly after receives from Cu_1 a long branch, *m-cu*, and then turns to run longitudinally in line with the course of *m-cu*. Thus between R+M and the weak main stem of M above, M_{3-4} and the basal piece of M_4 distally, and Cu_1 and *m-cu* below, a closed cell is formed, which we shall call the *medio-cubital cell*. In this cell lie the remains of an irregular and weak meshwork or archedictyon, which varies according to the species. Cu with very weak main stem, dividing quite close to the base into Cu_1 and Cu_2. Cu_1 gives off first the already mentioned branch *m-cu*, and then divides into two main branches Cu_{1a} and Cu_{1b}, both of which reach the wing-margin. Cu_2 becomes the *vena dividens*, separating the clavus from the rest of the wing, and lying in a deep groove close to 1A, except at its distal end, where it diverges from 1A considerably. Clavus with two distinct, unbranched veins, 1A and 2A, the former straight, the latter curved, and arising from the posterior border of the wing near its base. Cross-veins present are only *r-m*, the elongated *m-cu* (possibly a true branch of Cu_1), the irregular meshwork in the medio-cubital cell, and sometimes *cu-a*. *Hindwing*: Rs arising at from one-fourth to one-third along the wing, unbranched, or perhaps sometimes branched distally. M only three-branched. Cu_1 two-branched; Cu_2 a weak vein arising far along Cu, and becoming obsolete long before reaching the wing-margin. (Anal veins not well preserved, two or possibly three). Cross-veins present are only *r-m*, *m-cu* (short in this wing) and *cu-a*, with sometimes *sc-r* and another *r-m* situated more basally between the main stems of R and M.

Genotype, *Mesogereon neuropunctatum* Till. (Upper Triassic, Ipswich, Q.).



Text-fig. 65.—*Mesogereon neuropunctatum* Tillyard. Details of venation in forewing. (x $6\frac{3}{4}$).

MESOGEREON NEUROPUNCTATUM Till. (Pl. xxi., fig. 24; Text-fig. 65.)

Tillyard, Q'land Geol. Surv., Pub. 253, p. 34. Plate i., Figs. 1, 2.

A fragment of a forewing, measuring 23 mm. greatest length by 17 mm. greatest breadth. Studied in the light of the new material, this fragment is found to consist of a small portion of a very large wing, probably between 50 and 60

mm. long and with a greatest breadth of 15 mm. or more. Portions of all the veins from Sc to Cu_{1b} are preserved, but the wing is broken about the middle of the preserved portion of Sc, so that this vein, R_1, Rs, M_1 and M_2 are all badly bent. Origin of Rs not visible. Forks of M_{1-2} and M_{3-4} are both clearly preserved, the distance between them being 4 mm. The bent basal piece of M_4 lies just within the basal edge of the fragment, and is 0.6 mm. long. These measurements are useful for comparison with the wings of the other species. In Fig. 1 of my original description of this wing, the vein marked C is Sc, Sc is R_1, R is Rs, the two veins marked M are M_1 and M_2 respectively, while the two marked Cu are M_3 and M_4. Below these, crossing the posterior angle of the fragment, are a shorter piece of Cu_{1a}, and a minute portion of Cu_{1b}, the latter labelled A in the figure.

The cross-ridging of the main veins, and the tuberculated areas lying between them, are fairly well shown, as may be seen from a study of Plate xxi., fig. 24, of this paper.

Type, Specimen No. 19*a*, in Coll. Queensland Geol. Survey, Brisbane, Q. *Type-counterpart*, Specimen No. 19*b* in same collection.

Horizon, Upper Triassic, Ipswich, Q.

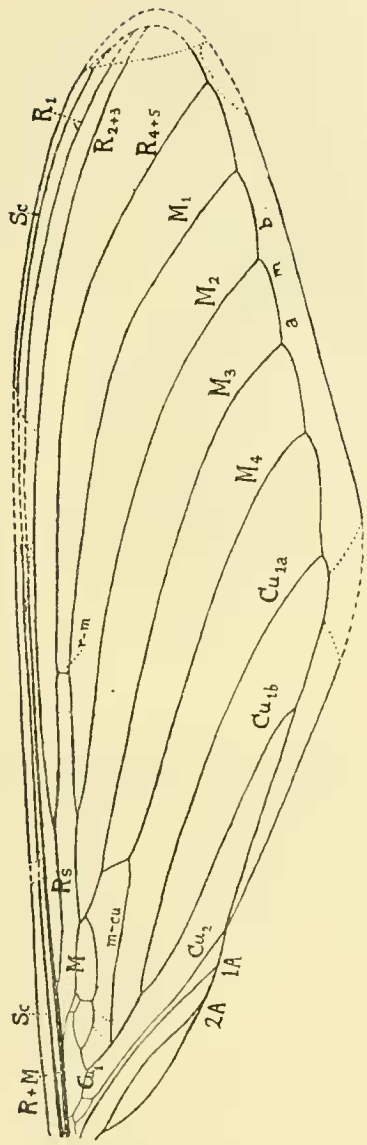
Mesogereon superbum, n.sp.

(Text-figs. 66, 67, and Plates xvi., xvii., xviii., Figs. 18—20.).

A remarkably preserved forewing, complete except for a portion of the costal margin and a small piece missing from the extreme tip. *Greatest length*, 44.5 mm., representing a wing about 46 mm. in total length. *Greatest breadth*, 12 mm., which is also the greatest breadth of the complete wing.

The scheme of the venation is shown in Text-fig. 66. The wing is long and narrow, the costal margin straight from base to half-way, and then very slightly convex. The extreme apex is missing, but appears to have been moderately rounded, or perhaps very slightly pointed. Posteriorly, the wing margin shows a very obtuse angulation about half-way, this angle being the *tornus*, separating the true *dorsum*, or basal portion of the posterior margin, from the *termen*, or part lying between apex and tornus. R_{2-3} runs to apex, and Cu_{1a} ends up just above the tornus. Sc and R_1 are crowded together close up to the costal margin for their whole lengths, diverging very slightly indeed towards the apex. R and M are fused together for a short basal stretch, after which M separates off as a very weakly indicated vein, supported beneath by the irregular meshwork of the medio-cubital cell described below. A little beyond the origin of M, Rs separates off from R as a strong vein running just below R_1, and dividing into R_{2-3} and R_{4-5} at a point about one-fourth of the wing-length from the base. R_{2-3} runs close under R_1 for some distance, then diverges very slightly from it in the distal half of the wing, and finally converges towards it again very slightly near the apex, where it ends. This vein remains unbranched throughout. R_{4-5} diverges slightly from R_{2-3} at its origin, and then runs sub-parallel to it for about half its length. More distally, it diverges considerably from R_{2-3}, and ends up some distance below the apex. At about two-fifths of the wing-length from the base, R_{4-5} is connected with M_1 by a short but well marked crossvein, *r-m;* slightly basad from this there is an appearance of a second, much more weakly formed cross-vein, indicated by the dotted line in Text-fig. 66.

At about one-fifth of the wing-length from the base, M forks dichotomically into two main branches. The upper of these, M_{1-2}, runs to a point just distad



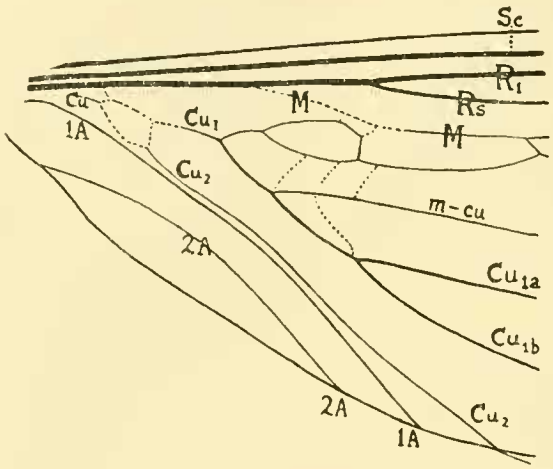
Text-fig. 66.

Mesogereon superbum, n.sp. Venation of forewing. (x 3¼).

from the level of the origin of Rs, and then forks again dichotomically into M_1 and M_2. The lower, M_{3-4}, runs only about half the distance of the upper, and then forks uniserially. M_3 continuing the line of M_{3-4}, while M_4 diverges sharply posteriad for a short distance, until it meets a longitudinal branch from Cu_1 (*m-cu*); it then turns distad so as to continue the line of *m-cu*. From this point on, the wing is divided evenly by the series of very slightly diverging veins M_1, M_2, M_3 and M_4, with the branches of Rs continuing the series anteriorly, and the branches of Cu_1 posteriorly. Distance between fork of M_{1-2} and fork of M_{3-4}, 2.5 mm.; length of basal piece of M_4, 1.2 mm. The *medio-cubital cell* is closed basally by a short weak cross-vein descending from R+M on to the very weakly formed main stem of Cu (both of these being barely visible), and ends distally at the basal piece of M_4. Within it is to be seen the peculiar and very irregular formation of veinlets shown in Text-fig. 67. These consist of a fairly strongly marked curved longitudinal vein running from Cu_1 very close to the base to join M_{3-4} slightly distad from its origin. This vein is divided, just before half-way, by a transverse vein above it, which forms the distal boundary of a small closed cell lying just below M, and connected with it by two very short and weak cross-veins; the small cell is completed by a convex vein above, arising from the long vein already mentioned at a point slightly distad from its origin. Below this small cell are two oblique cross-veins, weakly formed, with a third similar cross-vein descending from the long vein on to *m-cu* just distad from them. This peculiar formation should be compared with the simpler formation to be met with in the same area of *M. affine*, n.sp.

The very weakly formed basal piece of Cu forks quite close to the base into Cu_1 and Cu_2 (Text-fig. 67), both of these being weakly indicated for a short distance, until they are connected by a weak cross-vein. Beyond that point they begin to strengthen, Cu_1 soon becoming a very strong convex vein, which

gives off, anteriorly, the long connecting vein *m-cu*, already mentioned in connection with M_4, and then divides into Cu_{1a} and Cu_{1b} at a point level with the origin of Rs; these two veins run in a gentle curve to the wing-border, Cu_{1a} ending up above the tornus, Cu_{1b} more basally on the dorsum. Cu_2 lies in a deep groove in the anal furrow, forming the *vena dividens*, with its apex at the termination of the *coriaceous border*.



Text-fig. 67.—*Mesogereon superbum*, n.sp. Venation of base of forewing. (x 6¾).

The *clavus* is short and narrow, ending distally at a point abont level with the first forking of M. There are only two anal veins, of which 1A is nearly straight, and runs very close up to Cu_2, except distally, where these two veins diverge, while 2A forms a very flat loop, arising and ending on the posterior border of the clavus.

The whole of the wing between the radius and the clavus carries the cross-ridges and flat tubereulated areas typical of the family. These are well shown in Mr. Davies' beautiful photographs reproduced in Plates xvi.—xviii., figs. 18, 19, 20. That the tubercles were the swollen sockets of macrotrichia is well seen by a study of the enlargement in Plate xvii., fig. 19, in which the impressions of the hairs can be very clearly seen, especially in the forks between M_{1-2} and M_3, and between M_3 and M_4.

From just above the apex of the wing right round the termen and dorsum to the distal end of the clavus, there is a well preserved *coriaceous border*, separated from the rest of the wing by the *ambient vein* (*amb.*). This border shows a definite cross-ridging of considerably smaller calibre than that shown along the main veins, as may be seen from a study of Plate xviii., fig. 20. The coriaceous border in the wings of recent *Cicadidae* shows a similar cross-ridging, but the ridges stand much further apart. The ambient vein (*amb.*) forms a series of slight bays between the ends of each pair of consecutive main veins, much as in the case of recent *Cicadidae*, but with the individual bays not so strongly formed.

Type, Specimen No. 169, in Coll. Queensland Geol. Snrvey, Brisbane, Q.

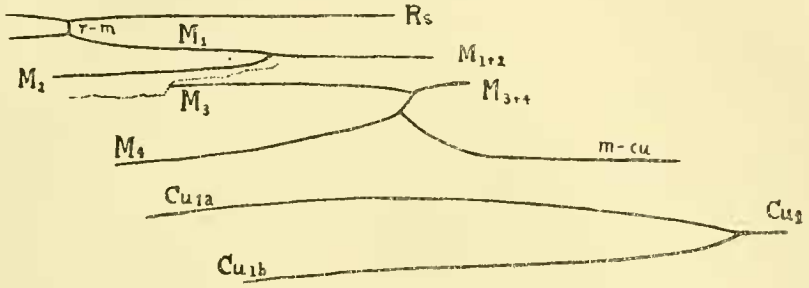
Horizon, Upper Triassic, Ipswich, Q.

Of all the fossils so far found at Ipswich, this wing is perhaps the most perfectly preserved as regards the minute structure of the veins and membrane.

MESOGEREON COMPRESSUM, n.sp. (Text-fig. 68.)

A nearly complete but very poorly preserved forewing, in which the longitudinal veins have been compressed together to some extent, especially from the costa down to M_3. *Greatest length,* 42 mm., representing a total length of about 45 mm. *Greatest breadth,* only 8 mm., representing a true wing-breadth of about 12 mm.

The extreme base of this wing is missing, owing to a diagonal break from near the base of *m-cu* up to and including the first fork of M. The whole of the clavus is absent, and also a narrow strip along the termen, including the coriaceous border. Text-fig. 68 shows a portion of the wing, including the cross-vein *r-m* and the forks of M_{1-2}, M_{3-4} and Cu_1. The cross-vein *r-m* is very short, each of the two main veins Rs and M_1 being curved in slightly at this point, and then diverging slightly again distad. As a result of compression, together with, per-



Text-fig. 68.—*Mesogereon compressum*, n.sp. Details of venation of forewing. (x 6¾).

haps, a longitudinal split, the space between M_2 and M_3 has become greatly lessened; and M_3, lying at a lower level than M_2 on the rock surface, disappears under the slight ridge on which this latter vein lies. Distance between fork of M_{1-3} and fork of M_{3-4}, 2.9 mm. (possibly a little more in the uncompressed wing); length of basal piece of M_4, 0.6 mm. Cross-ridges clearly marked, tuberculation weak.

Type, Specimen No. 144*a*, in Coll. Queensland Geol. Survey, Brisbane, Q. *Type-counterpart,* specimen No. 144*b*, in same collection.

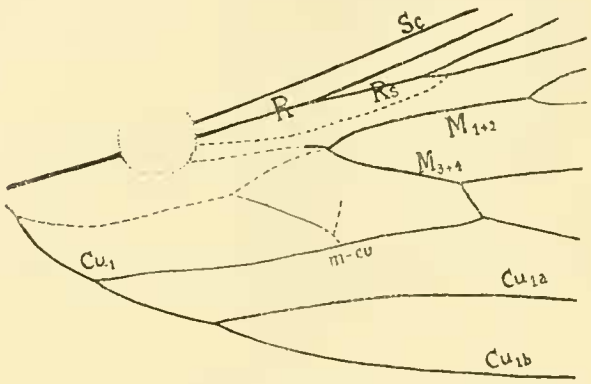
Horizon, Upper Triassic, Ipswich, Q.

MESOGEREON AFFINE, n.sp. (Text-figs. 69, 70, Plates xix., xx., Figs. 21, 22.)

Specimen No. 206*a* represents a nearly complete forewing with most of the termen missing, and with all four branches of M broken along an oblique line in the distal part of the wing, so that their distal ends bend downwards at a well marked angle. *Greatest length* of fragment, 35 mm., representing a total length of wing of about 40 mm. *Greatest breadth*, 11.5 mm., representing a total width of about 12 mm.

Text-fig. 69 shows the well preserved basal portion of this wing, excluding the clavus. A small round hole made by a sharp instrument near the base of R is indicated by the finely dotted circle. It will be seen that the origin of

Rs is at the same level as the first fork of M, while the fork of Rs is at the same level as the origin of M_4. Distance between fork of M_{1-2} and fork of M_{3-4} 2.5 mm.; length of basal piece of M_4, 1.2 mm. In the medio-cubital cell, the



Text-fig. 69.—*Mesogereon affine*, n.sp. Venation of base of forewing. (x 6·4).

remains of the archedictyon consist only of the long vein running from near the base of Cu_1 to the fork of M, together with a vein descending obliquely from it on to *m-cu;* from near the lower end of this latter vein, a short broken stump runs upwards towards M_{3-4}, but ends half-way across the cell. There is also a weakly formed veinlet running longitudinally in the space between R and M, and ending on Rs just distad from its origin. Cross-ridging very distinct; tuberculation moderately well preserved.

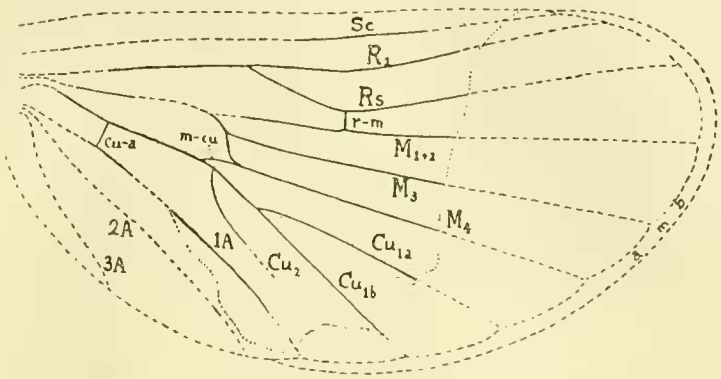
Type, Specimen No. 206*a*, in Coll. Queensland Geol. Survey, Brisbane, Q. *Type-counterpart*, specimen No. 206*b*, in same collection.

Horizon, Upper Triassic, Ipswich, Q.

Specimen No. 207*a* was found not far from No. 206, and is shown in Plate xx., fig. 22. Text-fig. 70 shows a drawing of the preserved parts of the venation, with the rest of the wing restored by broken lines. The close resemblance to the venation of the hindwing of a Heteroneurous Moth will be at once evident. I was for a long time in doubt as to whether this wing did not really belong to the Lepidoptera. The absence of any portion of the termen, from which it might be determined whether a coriaceous border was present or not, made the problem a difficult one. But finally a portion of the border was discovered in another closely similar hindwing (No. 97). This discovery made it certain that both specimens No. 97 and No. 207*a* were hindwings belonging to the genus *Mesogereon*. Specimen No. 207*a* is here considered to be the hindwing of *M. affine*, as it was found so close to the forewing of that species.

Comparing the hindwing with the fore, it will be seen at once, from the more normal positions of Sc and R, that the hindwing was considerably broader than the fore in comparison with its length. The preservation of part of the distal border in No. 97 enables us to estimate very closely the actual shapes of these wings, which are then seen to bear very much the same relationship to the forewings that those of a recent Cicadid do to their corresponding forewings. Rs arises a little beyond one-third of the wing-length, and runs obliquely downwards

until, at about half-way along the wing, it is joined to M_{1-2} by the short cross-vein *r-m*, closely resembling that of the forewing. The basal part of M is weakly formed; it divides unilaterally into M_{1-2} above, continuing the course of M, and M_{3-4} below; this latter vein proceeds obliquely downwards a very short distance, and then divides into M_3 and M_4, the former running straight through the wing to



Text-fig.70.—*Mesogereon affine*, n.sp. Venation of hindwing. Missing portions restored by broken lines. For lettering, see p. 284. (x 4½).

the middle of the termen, the latter curving downwards to meet a short branch from Cu_1 (*m-cu*), and then turning to run sub-parallel to and beneath M_3 to the termen. Cu is clearly marked, and is joined to 1A by means of a strong cross-vein *cu-a*. What appears to be the true Cu_2 is a weakly formed furrow-vein arising just beyond the origin of *m-cu*, and soon becoming obsolescent; it fails to reach more than half-way to the wing-border. Cu_1 continues the line of Cu with a slight bend downwards, and soon forks into Cu_{1a} and Cu_{1b}, which diverge to run straight to the wing-border. 1A appears to be well developed; the rest of the clavus is missing. *Greatest length*, 11 mm. *greatest breadth*, 9 mm., representing a wing of about 21 mm. total length by 11 mm. breadth.

This wing is very finely pitted all over, each minute pit having been apparently the socket of a small hair. There are no cross-ridges on the main veins.

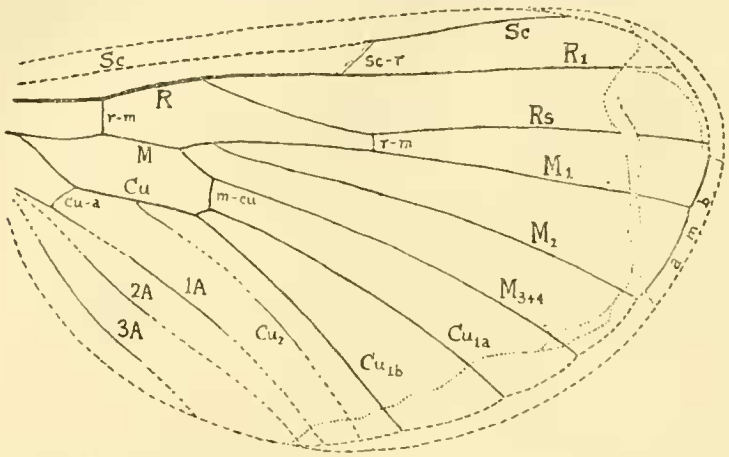
Type, Specimen No. 207*a*, in Coll. Queensland Geol. Survey, Brisbane, Q. *Type-counterpart*, specimen No. 207*b*, in same collection.

Mesogereon shepherdi, n.sp. (Plate xx., Fig. 23, and Text-fig. 71.)

This species is represented by a hindwing only, complete except for the absence of the costal border, a small piece around the apex, the lower portion of the termen, and most of the clavus. *Greatest length*, 21 mm., *greatest breadth*, 11 mm., the former representing practically the full length of the wing, the latter indicating a total breadth of about 13 mm.

Structure and venation generally similar to those of the hindwing of *M. affine* described above, but with the following differences:—R is connected with M close to the base by a strong cross-vein, *r-m*. About half-way along the wing, R is also connected with Sc by an oblique cross-vein, *sc-r*. Rs arises closer to the base than in *M. affine*, but the cross-vein *r-m* which corresponds with that in *M. affine* remains in the same position about half-way along the wing; consequently the piece of Rs from origin to cross-vein is longer in *M. shepherdi*, and

the bend at the cross-vein less marked. M is three-branched, but it is the upper branch, M_{1-2}, which divides into two, while the lower, M_{3-4}, appears to run straight to the termen. Cu_1 divides into two at a level slightly distad from that



Text-fig. 71. *Mesogereon shepherdi*, n.sp. Venation of hindwing. Missing portions restored by broken lines. For lettering, see p. 284. (x 4½). Note the presence of two radio-median crossvoins, *r-m*.

of the first fork of M; the upper branch, Cu_{1a}, is connected with M_{3-4} by a strong cross-vein. (It would be possible to interpret this cross-vein as the basal piece of M_4; in which case M would become four-branched and Cu_1 simple in this species; it is not easy to say which interpretation is really the correct one). The origin of Cu_2 is not clear, but appears to be about half-way between *cu-a* and the forking of Cu_1. The cross-vein *cu-a* is present near the base, but somewhat more oblique than in *M. affine*.

Cross-ridges are absent on the main veins, but clearly present on the coriaceous border, a portion of which is preserved between the ends of veins Rs and M_2. This part of the wing is shown much enlarged in Plate xxi., fig. 25.

Type, Specimen No. 97 in Coll. Queensland Geol. Survey, Brisbane, Q.

Horizon, Upper Triassic. Ipswich, Q.

Table of Some Important Differences in the Forewings of the Known Species of Mesogereon.

	Measurements (in mm.).	*M. neuropunctatum.*	*M. superbum.*	*M. compressum.*	*M. affine.*
(1).	Estimated total length.	50 - 60	46	45	40
(2).	Estimated total breadth.	15 - 17	12	12	12
(3).	From fork of Rs to fork of M_{1+2}.		0·9		2·3
(4).	From fork of M_{1+2} to fork of M_{3+4}.	4·0	2·5	2·9	2·4
(5).	Basal piece of M_4.	0·6	1·2	0·6	0·9
(6).	Angle of M^4 to fork of Cu_1.		5·7	6·3	6·0
(7).	Ratio of (4) to (5).	6·7	2·1	4·8	2·7
(8).	Ratio of (6) to (5).		4·7	10·5	6·7

Discussion of the Relationship of the Genus Mesogereon with the Jurassic Palaeontinidae.

In my work on the Panorpoid Complex, I followed Handlirsch in considering the Jurassic family *Palaeontinidae* as belonging to the Order Lepidoptera (1908, pp. 654-8). I pointed out, however, certain characters which prevented us from assigning them to either of the two Sub-orders of the Lepidoptera existing to-day, and suggested that they should be considered as a separate Sub-order Palaeontinoidea.

It is, of course, well known that both Oppenheim (1888) and Haase (1890) considered certain of the *Palaeontinidae* which they described to be Homoptera related to the *Cicadidae;* viz., the genera *Prolystra, Beloptesis* and *Eocicada.* Others were placed in the Lepidoptera, viz. *Phragmatoccites* and *Palaeocossus.* Butler placed the well known forewing of *Palaeontina oolitica* in the Lepidoptera. Thus there was, from the first, considerable doubt about the correct position of these fossils. Handlirsch, after studying many of the type-specimens and describing other new species, summed up his conclusions as follows (1908, p. 619, translated from the original German) :—

(1) In several of these fossils the covering of scales on the wings is quite plainly visible.

(2) The *Limacodidae* just mentioned do not visit flowers, and are, no doubt, old forms whose mouth-parts remain at an archaic stage of development, similar to the *Hepialidae,* etc. (N.B. Handlirsch claims a close affinity between the *Palaeontinidae* and the existing *Limacodidae.*).

(3) The resemblance of these fossils to the Cicadas is only a very superficial one, and their venation can in no way be traced back to that of the Homoptera.

(4) The venation of the fossils is strikingly similar to the course of the tracheae in many pupae of recent Lepidoptera.

At the time when I discussed this family in the Panorpoid Complex, I had not, of course, seen any of the actual fossils, and had been content to accept Handlirsch's statement, that the covering of scales could be quite plainly seen in some of them. However, during my recent voyage round the world, I studied all those *Palaeontinidae* to which I could get access, and was surprised to find myself quite unable to agree with Handlirsch's conclusions. The results which I obtained may be briefly stated as follows:—

(1) The original type of *Palaeontina oolitica* Butler was studied by me in the Geological Museum, Jermyn Street, London. This is a very badly preserved impression of a forewing, from which it would be quite unsafe to draw any definite conclusions. It is clear, however, that M has four quite distinct branches, which occupy most of the distal portion of the wing, so that the branches of R, which are indistinct, are pushed up towards the costal margin. There is no sign of the formation of a Y-vein between M_4 and Cu_{1a}. Thus, in so far as this specimen offers any evidence at all, it is *not* in favour of any Lepidopterous affinity. (No sign of scales can be seen, but this could not be expected in so poorly preserved material.).

(2) Professor Lameere, of Brussels, kindly handed to me for study the original type of *Eocicada lameerei* Handl. With respect to this insect, Handlirsch has stated definitely that he could see the scales on the wings (1908, p. 627, "Am mehrerer Stellen haben die Schuppen ganz deutliche Eindrucke auf der Platte hinterlassen"). The specimen is only moderately well preserved, like most of the insects from the Solenhofen Beds. Handlirsch's photographic repro-

duction (1908, Atlas, Plate 1, fig. 11) scarcely does justice to it, and a careful study of the fossil under low powers of the microscope soon reveals some characters of unexpected interest. With respect to the wings, I searched most carefully for evidence of scales all over them, but have to confess that I could see no sign of them, though the peculiar semi-glazed and flattened grain of the rock might mislead one into thinking that scales were present. But I did discover, in a number of places, distinct evidence of the presence of comparatively large tubercles in the areas midway between the main veins. These tubercles closely resemble those of *Mesogereon* in size, number and arrangement. The fact of their presence makes it quite certain that scales are *not* present. I next searched for signs of the transverse ridging of the main veins, but failed to find any indication of this. Finally, following round the margin of the forewing, I looked carefully for signs of a coriaceous border, with the result that I am able to state definitely that such a border did exist in this fossil, as clear signs of it can be seen in several places, by the use of careful lighting. Turning next to the body, it was possible to make out fairly definite indications of hairiness on the abdomen. The head is certainly not as small as Handlirsch supposes. The part which he takes for the whole head is only a small projecting frontal shelf, much like that of recent Cicadas. On either side of this there can be seen a largish oval depression, which is surely that of the compound eye. These two eyes, then, are large and stand wide apart, like those of recent Cicadas. Projecting on either side between the eye-depression and the frontal shelf, there can be seen faintly a short projecting filament, which is almost certainly the impression of the antenna, and corresponds exactly in shape and position with the antenna of a true Cicada.

The venation of this fossil, as far as it is preserved, closely resembles that of *Mesogereon*. Sc and R are pressed close up towards the costal margin, while little space is allotted for Rs, and there is certainly no justification for the restoration of the full four branches of Rs apically, as Handlirsch has shown them. Most of the distal area of the wing is occupied by the four very prominent branches of M, very similar to those of *Mesogereon*. M_4 has a short basal piece, and is then bent, as in *Mesogereon*, at the point where it receives a long branch from Cu_1 (the branch which I have called *m-cu*). Cu_1, after giving off *m-cu*, branches again into Cu_{1a} and Cu_{1b}, exactly as in *Mesogereon*. The hindwing is greatly reduced and poorly preserved. Two forked veins can be seen, separated by a single vein. The single vein is clearly a part of M, the main stem of this vein being clearly visible. If this vein be M_{3-4}, then the forked veins above it are probably M_1 and M_2, as in *Mesogereon shepherdi*. The forked veins below M_{3-4} are evidently Cu_{1a} and Cu_{1b}, as in *Mesogereon*.

As regards Handlirsch's remark that the venation of *Palaeontinidae* resembles the courses of the tracheae in pupal wings of recent Lepidoptera, it might with more than equal truth be said that they also resemble the courses of the tracheae in the nymphal wings of recent Cicadas.

From my study of *Eocicada lameerei*, I am forced to conclude that this fossil is a Homopteron, closely related to *Mesogereon* and less closely to the recent *Cicadidae*.

(3) There are, in the Museum of Comparative Zoology at Cambridge, Mass., a whole drawer full of Solenhofen fossils belonging to the *Palaeontinidae*. These are undescribed, but classified as Hemiptera. These fossils would well repay a fuller study than I was able to give them. Although for the most part in poor preservation, it is possible to find in them plenty of evidence in support of the Homopterous nature of the *Palaeontinidae*. None of them shows signs of scales,

but the tuberculation of the forewing is faintly indicated in places, and so is the presence of the coriaceous border.

Reviewing the above evidence as a whole, I am forced to the conclusion that Handlirsch has committed a serious error in claiming that the *Palaeontinidae* belong to the Lepidoptera, and more particularly in making the definite statement that scales are to be seen on these fossil wings. As far as the material which I studied can be considered typical of the family, there is certainly no evidence of any Lepidopterous affinities. On the contrary, the general build of the insects, the venational scheme, and what little can be discovered of the armature of the wing and the structure of the margin, leave no doubt whatever in my mind that the *Palaeontinidae* are closely related to the genus *Mesogereon,* and that both have a less close connection with recent *Cicadidae.* Though it is not possible to prove definitely that either *Mesogereon* or the *Palaeontinidae* represent the original ancestors of the Cicadas, yet we can definitely state that those ancestors must have closely resembled these fossils.

Present knowledge of the genus *Mesogereon* would lead me to abandon my former claim that they show any affinity with the Protohemiptera, as represented by *Eugereon,* though I am still prepared to see, in the cross-ridging of the main veins and the presence of a remnant of an archedictyon in the medio-cubital cell, evidences of a descent from forms possessing a complete original mesh work of weak veinlets, such as is found in most of the Carboniferous fossils.

A restoration of the complete insect belonging to the genus *Mesogereon* should show it as a Cicada-like insect having roughly-haired forewings held roof-wise over a moderately stout and probably hairy body; the hindwings smooth and transparent, hidden beneath the forewings, and probably with the anal area folded. There was no sound-producing apparatus comparable with that of recent Cicadas. The voiceless, hairy Cicadas of the genus *Tettigarcta,* confined at the present day to Victoria and Tasmania, perhaps represent the closest approach, amongst living insects, to these interesting Upper Triassic fossils, whose discovery cannot fail to add much to our knowledge of, and interest in, the Homoptera as a whole.

Cawthron Institute, Nelson, N.Z. 7.3.21.

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Note on the numbering of the figures.—The numbers of the figures in this series of papers were intended to run consecutively from Part to Part. Owing to

an inadvertence, the Text-figures of Part 7 were not so numbered. Forty should be added to the number of each Text-fig. in Part 7, so that the last one is 64, not 24. Thus this Part begins with No. 65. In the same way, the figure on the Plate accompanying Part 4 should be number 15, and the two figures on the Plate issued with the Queensland Geological Survey reprints of Part 5 should be Nos. 16 and 17.

EXPLANATION OF PLATES XVI.–XXI.

[All the plates are reproductions of photographic enlargements taken by Mr. W. C. Davies, Curator of the Cawthron Institute, by means of vertical camera extending to 42 inches, Aldis anastigmat lens (F 6·5, No. 00), and nearly horizontal electric light with condenser].

Plate xvi.

Fig. 18. *Mesogereon superbum*, n.sp. Forewing. (x 4·1).

Plate xvii.

Fig. 19. *Mesogereon superbum*, n.sp. Base of forewing. (x 10·9).

Plate xviii.

Fig. 20. *Mesogereon superbum*, n.sp. Portion of forewing, much enlarged, to show ambient vein and coriaceous border. (x 16).

Plate xix.

Fig. 21. *Mesogereon affine*, n.sp. Forewing. (x 5·65).

Plate xx.

Fig. 22. *Mesogereon affine*, n.sp. Hindwing. (x 5.6).

Fig. 23. *Mesogereon shepherdi*, n.sp. Hindwing. (x 5).

Plate xxi.

Fig. 24. *Mesogereon neuropunctatum* Tillyard. Genotype. Fragment of forewing. (x 8).

Fig. 25. *Mesogereon shepherdi*, n.sp. Portion of hindwing, much enlarged, to show a piece of the ambient vein and coriaceous border. (x 16).

LETTERING OF TEXT-FIGURES.

1A, 2A, 3A, the three anal veins. *amb*, ambient vein. Cu, cubitus. Cu_1, Cu_2, its two main branches, the former dividing into Cu_{1a} and Cu_{1b}. *cu-a*, cubito-anal cross-vein. M, media. M_{1+2}, M_{3+4}, its two main branches, of which the former divides into M_1 and M_2, the latter into M_3 and M_4. *m-cu*, medio-cubital cross-vein (in forewings of *Mesogereon* this is much elongated, and may be a true anterior branch of Cu1). R, radius. R_1, its anterior main branch. Rs, its posterior main branch, or *radial sector*, which divides into R_{2+3} and R_{4+5}. *r-m*, radio-median cross-vein (there are two of these in hindwing of *M. shepherdi*, n.sp.). Sc, subcosta. *sc-r*, subcosto-radial cross-vein.

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